Interface Control Document
Between the Network Control Center (NCC)
User Planning System (UPS)
and the Electronic User

March 1994

Prepared Under Contract NAS5-31000/HQ001057

Reviewed by:

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Goddard Space Flight Center
Greenbelt, Maryland

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Preface

This document is under the configuration management of the Mission Operations Division (MOD) Configuration Control Board (CCB). Configuration change requests (CCRs) to this document shall be submitted to the MOD CCB, along with supportive material justifying the proposed change. Changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This interface control document (ICD) describes the interface between the User Planning System (UPS) and its electronic users. Sections 1 and 2 provide an introduction and an application layer description that summarizes the files transmitted via this interface. Section 3 describes the presentation layer. Section 4 describes the session layer. Section 5 describes the transport layer. Section 6 describes the network layer, which converts messages to packets and routes them to the correct destination. Section 7 defines the data link layer, and Section 8 describes the electrical and mechanical characteristics of the physical layer.

Keywords*: interface control document (ICD), electronic user, Network Control Center (NCC), User Planning System (UPS)*

Section 1. Introduction

1.1 Purpose and Scope

This interface control document (ICD) describes the interface between the Network Control Center (NCC) User Planning System (UPS) and the UPS electronic users (EUs). It defines the UPS/electronic user interface using the seven levels defined by the International Standards Organization (ISO) Open Systems Interconnection (OSI) standard as follows:

- Application control layer—Provides a means for application processes to access the OSI environment. This layer contains management functions and generally useful mechanisms to support distributed applications.
- Presentation layer—Defines the syntax of the data, i.e., the data unit and data structure conversions necessary for the application layer to interpret the information exchanged between application entities.
- Session layer—Defines how a logical circuit is established for controlling the dialog between interfacing facilities.
- Transport layer—Defines end-to-end communication protocol to ensure that data exchanges between processes in different systems are error free in sequence, with no losses or duplications.
- Network layer—Defines how messages converted to packets are routed from the source across a network to the correct destination. It is responsible for establishing, maintaining, and terminating connections across the communications facility.
- Data link layer—Defines the ability to reliably transmit data over a single circuit. It provides a means of activating, maintaining, and deactivating the link.
- Physical layer—Defines the electrical and mechanical characteristics of physical circuits.

Sections 1 and 2 provide an introduction and an application layer description that summarizes the files transmitted via this interface. Section 3 describes the presentation layer. Section 4 describes the session layer. Section 5 describes the transport layer. Section 6 describes the network layer, which converts messages to packets and routes them to the correct destination. Section 7 defines the data link layer, and Section 8 describes the electrical and mechanical characteristics of the physical layer.messages“”

1.2 System Description

This section provides background information on the facilities involved in the interface between the UPS and the electronic user. It describes their functions and how they support each other’s functional tasks through the exchange of data across the interface.

1.2.1 UPS

The UPS replaces the current mission planning terminal (MPT), which provides an interface to the NCC for Tracking and Data Relay Satellite System (TDRSS) communications scheduling and planning activities.“”“”

The UPS is a generic TDRSS space network (SN) planning system developed by the National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center (GSFC) Code 514 initially to satisfy the requirement of the Mission Operations Division (MOD) (Code 510) in support of the Multisatellite Operations Control Center (MSOCC). ’The UPS will ultimately support other existing MPT users and future missions. The initial UPS installation will be in the MSOCC facility as a replacement for the existing MSOCC MPT.

’ The main objectives of the UPS are to

- Provide a user-friendly interactive interface for users to enter TDRSS service requests.
- Automate the input of TDRSS scheduling from the command generation process by accepting batch schedule add requests (SARs) from the electronic user.
- Accept orbital data, including predicted site acquisition tables (PSATs) and user antenna views (UAVs), from the electronic user or the Flight Dynamics Facility (FDF). These data are stored for 4 weeks, including the event start week. The data, in combination with the user-specified option flags, are used to generate the Tracking and Data Satellite (TDRS) scheduling window (TSW). TSWs are used as an aid in determining feasible schedule request times and validating completed requests.
- Future releases of the UPS software (Post Release 3) may provide generic schedule request capabilities to its users. These capabilities include experimenter support requirements but not real-time requirements. The UPS will accept generic requests formulated by a member of the mission Flight Operations Team (FOT) and will generate the corresponding specific schedule requests to be sent to the NCC. Data used as input include TDRSS viewing periods, orbital data (such as orbit day and night, and anomalies), spacecraft-specific data, and user-defined constraint requirements.

1.2.2 Electronic User

The electronic user is defined as another computer system supplying schedule data and/or orbital data to the UPS.

The electronic user provides the UPS with orbital data, such as the PSATs and the UAVs to be used as TDRSS scheduling aids. It also provides batch input of SARs and report requests. The UPS responds with batch SAR acknowledgments, reports, and the forwarding of NCC messages. Multiple electronic usersmay be connected to a single UPS.

1.3 UPS Communication Interfaces

Figure 1-1 shows the equivalence between the seven levels of the OSI model and the Transmission Control Protocol/Internet protocol (TCP/IP) communications used by the UPS.

The communication interfaces and protocols to be supported by the UPS for any installation are shown in Figure 1-2. At a minimum, the TCP/IP, the Digital Equipment Corporation network (DECnet), and the NASA Communications (Nascom) protocols will be supported. The TCP/IP is intended for use by electronic users and by interactive UPS users using the X11 X-Windows standard. The DECnet communications protocol will be supported for electronic users who have DEC equipment with no TCP/IP support. The Nascom protocol is supported through the use of a TCP/IP-to-Nascom gateway for UPS/NCC communications.

Figure 1-1. UPS/Electronic User Communication Reference Model

Figure 1-2. Generic UPS Interface Configuration

Section 2. Application Layer

2.1 Introduction

The UPS to be interfaced to the electronic user operates in conjunction with the NCC Data System (NCCDS). The generic UPS, as developed by GSFC Code 514, exchanges Nascom 4800-bit message blocks with the NCCDS. The communication gateway of the UPS communicates with the NCCDS via the Nascom Message Switching System (MSS). The UPS forwards service support requests from the electronic user to the NCC scheduler, which responds with TDRSS support schedules for the spacecraft. These schedules are forwarded to the electronic user.

2.2 Interface Timeline Requirements

The electronic user/UPS interface definition depends heavily on the NCC/UPS and FDF/Payload Operations Control Center (POCC) interface requirements, which ultimately control the scheduling interface. This is especially true for defining scheduling interface timelines because the NCC operates its scheduling software on a somewhat fixed timeline.

2.2.1 UPS/NCC

Figure 2-1 shows the timeline projected for the scheduling interfaces between the electronic user, the UPS, and the NCC. Note that the timeline is approximate and is based on current NCC operations. SARs or schedule delete requests (SDRs) and user schedule messages (USMs) may be processed by the UPS at any time.

The electronic user-to-UPS interface timeline requirements for TDRS service are as follows: from The UPS receives the requests from the electronic user 28 to 14 days before the week of requested support. The forecast schedule, consisting of all events that have confirmed support, is issued by the NCC approximately 7 days before the week of requested support. After the NCC issues the confirmed schedules, the UPS accepts and forwards schedule update requests from the electronic user until 45 minutes before the start of the event in question. Between 45 minutes and 10 minutes before an event, any single-action request relating to the event is processed as a priority schedule request. ’

2.2.2 UPS/Electronic User

The UPS operates entierely in a network environment and must adhere to the time required for network planning and configuration. The UPS-to-electronic user timeline is summarized in Figure 2-1 and

Figure 2-1. UPS/Electronic User Scheduling and NCC Planning Interface Timeline

defined as follows: The generation of support schedule requests by the electronic user will begin as soon as the orbital data (e.g., PSAT and UAV) are available to the electronic user. Orbital data may be electronically transmitted to the UPS or may be transferred on FDF standard format tapes (see Reference 1). See Section 2.3 for details about orbital data transfers.

From 28 to 14 days before the beginning of the week being scheduled and as soon as the orbital data are available, mission planning activities can take place within the user's system, and support schedule requests can be generated for the supported spacecraft. These requests will be maintained by the electronic user during this period.

From 21 to 14 days before the beginning of the week being scheduled, the UPS will accept the support schedule requests resulting from the mission planning and scheduling process within the electronic user software system. The UPS will then store (and optionally validate) these requests in its database and forward them to the NCC.

From 14 days before the beginning of the week being scheduled until the forecast schedule is issued by the NCC (approximately 7 days later), the UPS will accept additional support schedule requests, store them in its database, and forward them to the NCC. The UPS will receive result messages from the NCC in response to these requests. The schedule requests represent changes to the mission schedule resulting from modified mission support requirements.

Approximately 7 days before the beginning of the week being scheduled, the UPS will receive the confirmed schedule from the NCC. These schedules consist of 7 days of confirmed schedules for TDRSS support of the user spacecraft. At the electronic user's request, the UPS can forward the confirmed schedules to the electronic user. The electronic user may also request other reports from the UPS database at any time.

From the receipt of the continued schedule by the electronic user until 'the time of load for the event in question, the UPS can accept active-period schedule requests and forward them to the NCC for immediate processing. The UPS will receive and store the results from the NCC, indicating acceptance or denial of the requests. In addition, the UPS will receive updated schedules resulting from accepted schedule requests. The UPS will maintain a database of the latest support schedules for the supported spacecraft based on both schedule deletion messages and schedule updates from the NCC. The latest support schedules for a specified time interval will be forwarded to the electronic user by the UPS upon request. 'See Section 2.4 for details about NCC/UPS message types.

2.3 UPS Orbital Data

The electronic user and/ “”therefore These data should be immediately forwarded to the UPS upon receipt by the electronic user. Forwarding is expected to take place approximately 28 days before the beginning of the week

being scheduled. sare

Table 2-1. Orbital Data Messages Between the UPS and the Electronic User

MsgType/ Msg Class	Description	From	To
97/04	PSAT message	EU	UPS
97/05	UAV messageD	EU	UPS

when **the** ingtransfers PSAT and UAV data to the UPS. Table 2-1 shows the messages related to orbital data exchanged between the electronic user and the UPS. The message types and classes in Table 2-1 are similar to those defined in STDN 230.1 (Reference 2), but are defined only between the UPS and the electronic user.

2.3.1 Predicted Site Acquisition Tables

The UPS receives PSATs from thethe electronic user for use as a scheduling aid in selecting possible support event time periods free of astronomical and mission-oriented constraints. The PSAT s*ICD*

contain predictive user spacecraft line-of-sight (LOS) view period times for each TDRS and each antenna. The standard PSAT also includes spacecraft orbital event data associated with the orbit day, orbit night, Sun interference periods, South Atlantic Anomaly, Van Allen belts, radio frequency interferences over the North Atlantic ocean, and zone of exclusion passages. The initial delivery has a timespan of 3 to 4 weeks, and each subsequent delivery will cover a 1- to 3-week period (most probably a 1-week period). The format of this file is defined in the *Flight Dynamics Division (FDD) Interface Control Document (ICD) for Generic Data Formats* (Reference 1). These data may be received electronically over the UPS/electronic user interface or via 1600-bpi magnetic tape (see Reference 1).

2.3.2 User Antenna Views

The UPS needs UAV to support the generation of generic schedule requests. The UAV data, in combination with the PSAT data, allow the UPS to generate TSWs to be used in validating SARss. The PSATs and the UAVs will be transmitted to the UPS from the electronic user, approximately 3 to 4 weeks in advance. The file format is found in the *FDD ICD* for generic data

formats (Reference 1). These data may be received electronically over the UPS/electronic user interface or by 1600-bpi magnetic tape (see Reference 1). , “” “”“” ““

2.3.3 Orbital Data Status Messages

Upon receipt and processing of orbital data from the user, the UPS will send a status message to notify the electronic user. The complete orbital data status message will be repeated for each validation error. The format of this message is defined in Appendix A.

2.4 Planning and Scheduling Interface Requirements

Table 2-2 summarizes the planning and scheduling activities messages transmitted between the UPS and the electronic user. Some of these message formats are defined in the *data format control document (DFCD) between POCC and NCC, STDN 230.1* (Reference 2); others are defined in Appendix A.

Table 2-2. Messages Between the UPS and the Electronic User for the Transfer of Planning and Scheduling Data

MsgType/Msg Class	Description	From	To
94	**User Schedule Messages**		
94/01	Normal User Schedule Message	UPS	EU
94/02	Emergency User Schedule Message	UPS	EU
94/03	Simulation User Schedule Message	UPS	EU
99/01	Schedule Delete Notification	UPS	EU
99/02	Schedule Result Message	UPS	EU
99/22	Input Schedule Request Status Message*	UPS	EU
99/10	Single-Action (Add) request message	EU	UPS
99/11	Single-Action (Delete) request message	EU	UPS
99/21	***Input Schedule request message****	***EU***	***UPS***
99/13	***Multiple-Action (Delete) Request****	***EU***	***UPS***

The following subsections describe the USMs and schedule messages listed in Table 2-2.

2.4.1 User Schedule Messages

The UPS will transmit all schedule messages for a given time interval to the electronic user upon request. The schedule will represent the initial conditions for a given event and will consist of a message header followed by one or more service descriptions. Each service description will consist of one or more service headers and a set of service parameter values, as needed by the ground system to configure a service. If several service descriptions of the same type are required, they will be ordered chronologically by start time of the service. Each service description will include values for any service parameters that are fixed for the spacecraft to be supported and initial values of any reconfigurable parameters required for that service.

The UPS will forward to the electronic user all (both normal and premium) confirmed schedules received from the NCC. These confirmed schedules will include the schedules resulting from the forecast scheduling process, which will occur 7 to 14 days before the week being scheduled. Confirmed schedules will also include schedule updates that result from single-action requests being granted during the active period.

2.4.2 Schedule Messages

Schedule messages include schedule delete notifications (SDNs), schedule result messages (SRMs), single-action and multiple-action schedule request messages, input schedule request (ISR) messages, and ISR status messages.

2.4.2.1 Schedule Delete Notification

The UPS attempts to forward all SDNs received from the NCC to the electronic user if their forward flags are on. After successful transmission of SDNs, the UPS will not retain the messages, but it will keep the status of each message.

2.4.2.2 Schedule Result Messages

The UPS will forward all SRMs for a given time interval to the electronic user upon request. This forwarding process is controlled through mission setup control flag or through UPS operator initiation. These SRMs are used by the UPS software to update the status of the TDRS service request. The request may be accepted, put in the spooling queue, or rejected.

2.4.2.3 Schedule Request Messages

The UPS receives single-action request, multiple-action request, or ISR messages from the electronic user. These requests are based on science support requirements and are used to request the addition of schedule events that require network resources. The requests are generated by electronic user software, which enables experimenters to formulate NCC support requirements for their science plans. These requests are then transmitted to the UPS. Upon receipt, the UPS stores them in its database, converts them to NCC format (if required), and forwards them to the NCC. The requests provide specific information regarding the TDRSS services being requested, the time period during which the services are required, and the service configuration needed for support.

The requests are contained in files that are transmitted from the electronic user to the UPS via the TCP/IP or DECnet protocols. There may be multiple requests per file. The file header fields are defined in Appendix A.

The UPS supports the following schedule request message formats used by the electronic user to transmit its support requirements to the UPS (see Table 2-2):

- SAR—This format is the same as that used between the UPS and the NCC, which is defined in STDN 230.1 (Reference 2). This message format is available to accommodate existing users who now use it to transmit to the MPT.
- ***SDR—This format is the same as that used between the UPS and the NCC, which is defined in STDN 230.1 (Reference 2). It is also supplied to accommodate existing users.***
- ISR—This format is defined in Appendix A. It was designed to allow the user to specify UPS processing options not available via the SAR format. These options include specifying the validation to be done by the UPS, the method to compute the tolerance, whether the request is to be automatically forwarded to the NCC, and the priority of the request (not included in UPS Release 3 baseline software).
- Multiple-action (Delete) request message—This format is used to request in a single message the deletion of a group of previous requests specified by a support identification number (SUPIDEN), time range, and (optionally) by station. This format is defined in Appendix A (not included in UPS Release 3 baseline software).
- Multiple-action (Time Shift) request message—This format is used to request in a single message the modification of the scheduled start times of a group of previous requests by a fixed time interval. The requests affected are specified by SUPIDEN and a time range. This format is defined in Appendix A (not included in UPS Release 3 baseline software).

ISR status message—On completion of batch schedule request (either SAR or ***ISR*** format) validation, the UPS generates this status message to summarize theresult of the validation. This message contains the request ID, start and stop time of the request, duration, prototype event ID, station ID, status, and explanation code. This format is defined in Appendix A (not included in UPS Release 3 baseline software).

2.4.2.4 Schedule Request Status Message

Upon completion of processing of an SAR/SDR/ISR received from the electronic user, the UPS returns a request status message as a nonblocked message (see Appendix A for message format). It includes a message header (9 bytes) that indicates the message number and size, and a variable-length portion containing the status of the SAR/SDR/ISR.

If an SAR/SDR/ISR passes validation, one status message is returned for each request, in the format

[message number + message size + variable-length message]

with the variable-length portion indicating the valid status.

If an SAR/SDR/ISR does not pass validation, a separate status sequence is returned for each validation failure for that request, with the variable-length portion indicating the reason for failure.

For example, if a request message contained 10 SARs and every SAR passed validation, the UPS would return a message with 10 sequences of the status message. However, if 1 of the 10 SARs failed three validation tests, the UPS would return 12 status sequences, one for each of the valid SARs, and one sequence for each validation failure of the offending SAR.

2.5 UPS/Electronic User Manual Interface Requirements

The UPS does not provide the electronic user with the capability to install or update the mission data that are required for schedule preparation. This information must be entered interactively into the UPS or copied from another mission on the UPS. In addition, the format to be followed in naming files sent from the UPS to an electronic user must be defined by that electronic user and recorded in the UPS database. The mission-specific data required for schedule preparation are discussed in Section 2.5.1. The convention and procedure for defining filenames is presented in Section 2.5.2.

2.5.1 Mission-Specific Data Required for Schedule Preparation

Before using the NCC/UPS functional interface, each supported mission project must provide certain information required for schedule preparation. The mission project will manually input this information into the UPS. The mission project must coordinate this information with the NCC before using data for scheduling. UPS report information is available to help provide this information. Any update of the data sent to the NCC requires synchronization with the NCC. The information will include the following, as necessary and applicable:

- Configuration codes—Descriptors that identify a predefined set of service parameters required for ground configuration of a given service type
- Prototype events—Combinations of configuration codes with associated start and stop times relative to an initial event time, defining a standard single-service or multiservice event for a given spacecraft mission
- Spacecraft characteristics—Spacecraft information that is mission unique, needed to schedule a spacecraft, and not included in the configuration codes or schedule requests
- Processing parameters—Includes processing flags, interactive parameters, and default values, among others

2.5.2 Defining UPS Filenames

This section presents two file-naming conventions and a procedure. The first file-naming convention will be used by the UPS in the UNIX environment. The second file-naming convention and the procedure for the electronic user will be used by the UPS to specify the filenames to be transmitted by the UPS to the electronic user. This latter is limited to the files

transmitted from the UPS over the local area network (LAN) via file transfer protocol (FTP) or DECnet to the electronic user.

2.5.2.1 UPS File-Naming Convention

The file-naming convention for the UPS in the UNIX environment, which the electronic user is required to follow when sending messages to the UPS, is

mdddhhmmss#TYP

where
- m = mission code, such as C for Cosmic Background Explorer (COBE)
- ddd = Julian day of creation
- hhmmss = the time of creation in hours, minutes, and seconds
- # = sequence character, a digit (0 through 9) that indicates the creation sequence for files of the same type created for the same mission within the same second
- TYP = file extension for message type, as follows:

  Files transferred from the electronic user to the UPS:

  - ISR = forecast-period ISR message
  - PIR = active-period ISR message
  - ORB = PSAT or UAV periods message
  - SAR = forecast-period SAR in NCC format
  - PSR = active-period SAR in NCC format
  - REQ = report generation request message

  Files transferred from the UPS to the electronic user:

  - ISS = ISR/SAR validation status message
  - ODS = orbital data validation status message
  - RPT = report message
  - NMG = NCC messages, (SDNs, SRMs, and USMs from autoforward function)
  - CFM = USMs from retransmission function

2.5.2.2 Electronic User File-Naming Convention and Procedure

This file-naming convention stems from the UPS objective to serve electronic users operating on different hardware and system software platforms. It is designed to create filenames that are both standardized and customized. Standardization is needed by the UPS so it can apply a single logic to generate the same class of information to be sent to different users. Customization is needed

by the electronic user to operate within the definitions for filenames imposed by its operating platrm.

The following discussion describes a syntax for file nomenclature that includes basic information that can be customized to suit an electronic user's individual needs.

- Basic information—The following basic information is available from the UPS and may be defined by the electronic user as part of the filename sent by the UPS:
  - UPS operational mode—The three-character operational mode, e.g., TST, SIM, OPS
  - UPS software environment—The three-character software environment, e.g., DEV, CCC, OPS
  - Mission—A one-character mission code defined by the electronic user for the UPS
  - Time stamp—The system date and time at the time of file creation by the UPS in the format DDDHHMMSS
  - Sequence number—A sequence number to differentiate between files with the same name created within the same second (except for the sequence number)
  - File type—The three-character file extension for files transferred from the UPS to the electronic user, as described in Section 2.5.2.1

  The electronic user may define all or any combination of these items to appear in any order in the filename.
- Customized information—In addition to the basic information, the electronic user may define one or more character strings of any length to be included in the filename. These character strings will enable to electronic user to customize the name of the file to accommodate its particular operating platform.
- The electronic user may define any number of or no character strings to be included with the basic information as part of the filename definition. The following examples illustrate this convention:
  - The electronic user is on an IBM/MVS platform and needs to know the UPS operational mode and the UPS software environment. In addition, it needs certain fixed information in the filename to be formatted as follows:

    Mode + "TSA." + Environment + ".NCC.DATA"

    According to this convention, the UPS running in an operations mode and an operation software environment would send the following file:

    SIMTSA.OPS.NCC.DATA
  - The electronic user is on a DEC/ULTRIX platform and needs to know the file type and the date and time the file was created by the UPS. In addition, the electronic

According to this convention, the UPS would send an ISR/SAR validation status message with the following filename:

[ISS]181090545.UPS

- Procedure—The electronic user can follow these procedures to define filenames for the UPS:
  - Electronic user platform and FTP or DECnet—The electronic user must first know how the interface between its platform and FTP is implemented, which depends on the hardware and network operating system. The electronic user's LAN communications manager should be able to provide this information.
  - Electronic user platform architecture—The electronic user must then decide where it wants the UPS files to fit within the overall architecture of its file system.
  - UPS mission coordinator—After the constraints imposed by FTP or DECnet are known and the UPS file architecture is decided, the electronic user should contact its UPS mission coordinator to discuss its file-naming convention. A test transfer across the LAN via FTP should be made to ensure that the convention will actually work. The UPS mission coordinator then records the electronic user's convention in the UPS database. From that point on, the convention automatically will be used to transfer files from the UPS to the electronic user.

The electronic user must define a file-naming convention for the UPS before files can be transmitted. No default exists that enables transmission of files from the UPS to the electronic user without a convention. The basic information available from the UPS may be used, the customized information from the electronic user may be used, or any combination of the two that is acceptable to FTP may be used.

2.6 UPS Report Generation Request and Response

The electronic user may request reports of the data in the UPS database. The electronic user initiates the request for data by sending a report request message to the UPS. The UPS will respond with a message containing the requested report. Table 2-3 summarizes the messages supported between the UPS and the electronic user for these purposes.

2.6.1 Report Generation Request Messages

This message allows the electronic user to request the transmission of any of the formatted reports available to interactive users of the UPS. The message contains the SUPIDEN, user ID, password, report identification, translation map identification, and start and stop time, if applicable. The format of this message is illustrated in Appendix A.

2.6.2 Report Generation Response Messages

The report generation response message returns one of the reports listed in Table 2-3. The message contains the report preceded by a header, laid out as follows:

- Header (values extracted from user's request message)
  - Spacecraft identification code (SIC)
  - User ID
  - Password
  - Report ID
- Report
  -

Formats for both the header and the contents of each of the message types are illustrated in Appendix A (Figure A-2 describing the nonblocked message format). A brief description of each report type follows. 'R 5

2.6.2.1 Requested Events Report

This report contains the TDRSS support requests for the specified SIC and time interval.

2.6.2.2 Confirmed Schedules Report

This report contains the TDRSS support requests scheduled and confirmed by the NCC for the specified SIC and time interval.

2.6.2.3 Rejected Events Report

This report contains the TDRSS support requests for the specified SIC and time interval that were rejected by the NCC.

2.6.2.4 Untransmitted Requests Report

This report contains the TDRSS support requests for the specified SIC and time interval that are ready for transmission to the NCC but have not yet been sent.

Table 2-3. Messages Between the UPS and the Electronic User for the Transfer of UPS Database-Generated Report Data

MsgType/ Message Class	Report ID	Description	From	To
93/40	NA	Report Generation request message	EU	UPS
93/41	01	Requested events report	UPS	EU
93/41	02	Confirmed schedules report	UPS	EU
93/41	03	Rejected events report	UPS	EU
93/41	04	Untransmitted requests report	UPS	EU
93/41	05	Transmitted requests report	UPS	EU
93/41	06	Autogenerated requests report	UPS	EU
93/41	07	Deleted Requests/Schedules Report	UPS	EU
93/41	08	Generic Schedules Report	UPS	EU
93/41	09	Daily support plan	UPS	EU
93/41	10	Spacecraft Individual Pass Plan	UPS	EU
93/41	11	Predicted Sun interference periods report	UPS	EU
93/41	12	Predicted anomaly periods report	UPS	EU
93/41	13	Configuration codes report	UPS	EU
93/41	14	Prototype event report	UPS	EU
93/41	15	Spacecraft Characteristics Parameters Report	UPS	EU
93/41	16	User-Defined Constraint Periods Report	UPS	EU
93/41	17	Activity log report	UPS	EU

NOTE: EU = Electronic User

- Report
  - Report writer-generated text
  - Lines 0-80 characters terminated by a linefeed

2.6.2.5 Transmitted Requests Report

This report contains the TDRSS support requests for the specified SIC and time interval that have been transmitted to the NCC.

2.6.2.6 Autogenerated Requests Report

This report contains the TDRSS support requests for the specified SIC and time interval that were autogenerated by the UPS based on user-defined autogeneration parameters.

2.6.2.7 Deleted Requests/Schedules Report

This report contains the TDRSS support requests or confirmed schedules for the specified SIC and time interval that were deleted by the UPS or the NCC.

2.6.2.8 Generic Schedules Report

This report contains the confirmed TDRSS support schedules for the specified SIC and time interval that do not match the request events transmitted to the NCC by the UPS.

2.6.2.9 Daily Support Plan

This report contains the chronological sequence of TDRSS events for the specified SIC and time interval. Based on confirmed events, the report is intended as an aid to the POCC for development of procedures to support the scheduled contacts during an operational day.

2.6.2.10 Spacecraft Individual Pass Plan

This report contains a chronological summary of scheduled TDRSS events for the specified SIC and time interval, plus selected spacecraft characteristics.

2.6.2.11 Predicted Sun Interference Periods Report

This report lists the time periods for the specified SIC and time interval when the alignment of the Sun could potentially interfere with a TDRSS service.

2.6.2.12 Predicted Anomaly Periods Report

This report lists the time periods for the specified SIC, anomaly, and time interval when the specified anomaly could potentially interfere with a TDRSS service.

2.6.2.13 Configuration Codes Report

This report contains the set of configuration codes for the specified SIC.

2.6.2.14 Prototype Event Report

This report contains the set of prototype event IDs defined for the specified SIC.

2.6.2.15 Spacecraft Characteristics Parameters Report

This report contains various mission-specific parameters needed by the UPS for the scheduling and validation requests for the specified SIC.

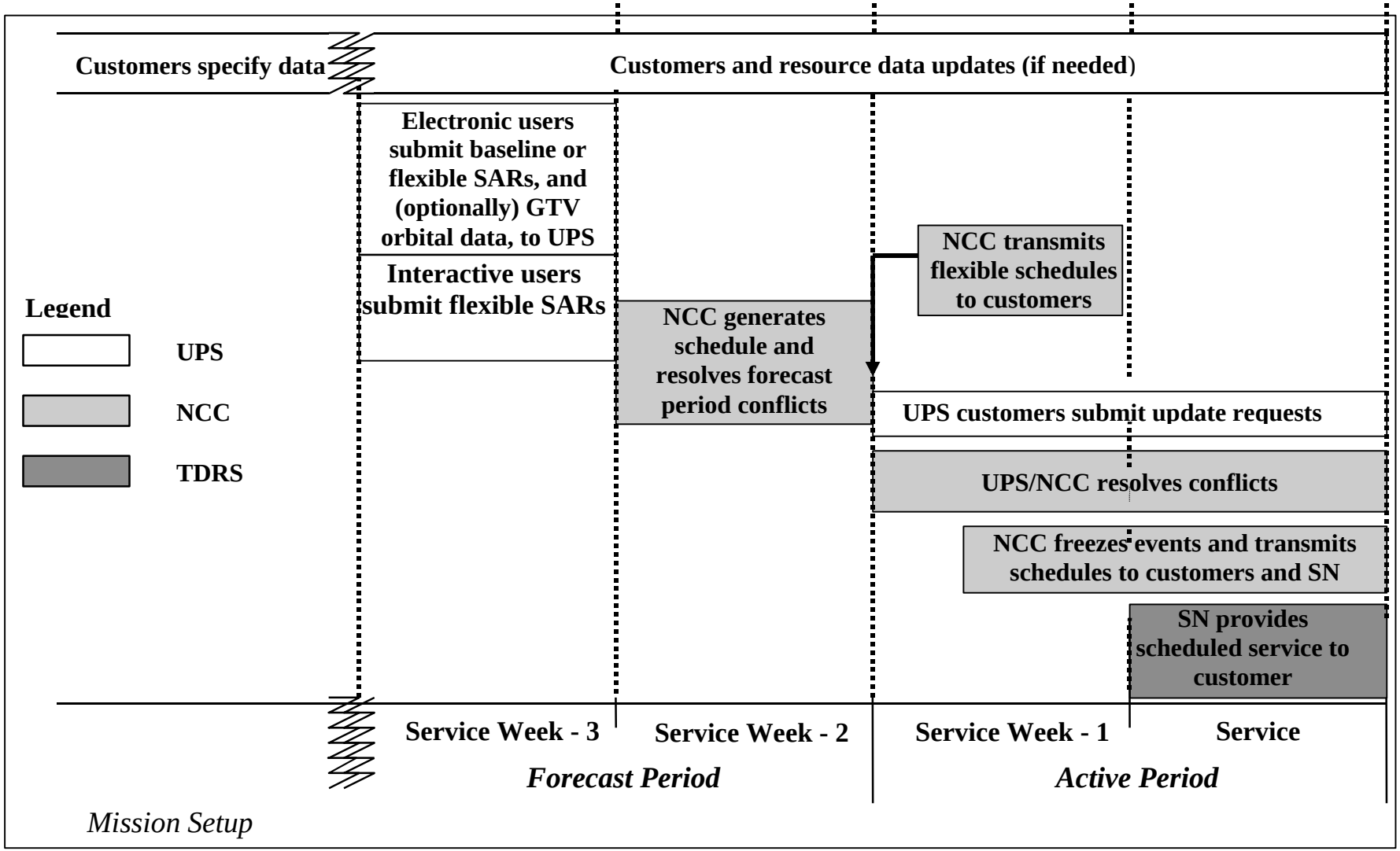
2.6.2.16 User-Defined Constraint Periods Report

This report lists service blackout periods for the specified SIC and time interval.

2.6.2.17 Activity Log Report

This report contains a summary of the message activity for the specified SIC and time interval.

loss of signal ()pecified SIC and time interval.


Customers specify data
Customers and resource data updates (if needed)
Electronic users submit baseline or flexible SARs, and (optionally) GTV orbital data, to UPS
Interactive users submit flexible SARs
NCC transmits flexible schedules to customers
NCC generates schedule and resolves forecast period conflicts
UPS customers submit update requests
UPS/NCC resolves conflicts
NCC freezes events and transmits schedules to customers and SN
SN provides scheduled service to customer
Legend
UPS
NCC
TDRS
Service Week - 3
Service Week - 2
Service Week - 1
Service
Forecast Period
Active Period
Mission Setup

Section 3. Presentation Layer

The presentation layer ensures data encoding compatibility across the interface between the UPS and the electronic user. This process involves defining the basic data encoding and data unit (i.e., bit strings, bytes) manipulation necessary for application software at each end of the interface to interpret the data according to the application layer data formats, such as American Standard Code for Information Interchange (ASCII) or Extended Binary Coded Decimal Interchange Code (EBCDIC). It also includes, along with the session layer, the FTP and small mail transfer protocol (SMTP) capabilities. This layer makes the hardware and software used to transmit the data transparent to the user.

All fields described in the applications layer are either binary or character strings. Character encoding in the UPS is in ASCII. Binary strings are formed in adjacent bytes, with the least significant bit (LSB) at the right.

Section 4. Session Layer

The session layer controls the program-to-program connection, selecting the best available network path, reading data, writing data, disconnecting, and statistics gathering. This selection process includes establishing the session connection and reporting exceptions.

This layer is implemented by the file transfer and mail services using FTP and SMTP. See Reference 3 for more information.

Section 5. Transport Layer

The transport layer software is responsible for managing the network path chosen by the session software. It actually moves data and is responsible for transmitting and receiving user data, along with internal protocol information. It also performs error recovery to ensure data transmission and integrity. The segmentation and desegmentation of user data is implemented by this layer. This layer makes the hardware and software used for transmitting the data transparent to the user.

This layer is implemented by the TCP. See Reference 3 for a detailed description of this protocol.

Section 6. Network Layer

The network layer software provides the functional and procedural means to exchange network services data units between two transport entities over a network connection. It provides transport entities with independence from routing and switching considerations.

This layer is implemented by the IP. See Reference 3 for a detailed description of this protocol.

Section 7. Data Link Layer

This level provides the ability to reliably transmit data over a single link. Link establishment and termination are not required. The circuit is permanently established within the electronic user in a ready-to-transmit state. The data transmitted across the interface will be encoded by the transmitter and will be error checked by the receiver.

This layer is implemented using Ethernet and Institute of Electrical and Electronic Engineers (IEEE) Standard 802.3. See References 3 and 4 for further information on Ethernet and IEEE 802.3.

Section 8. Physical Layer

The physical layer defines the physical connection between the computer and the network, including the mechanical aspects of the connections (cables and connectors) and the electrical characteristics (voltage, current levels, and techniques used to modulate and demodulate the signal). It provides procedure characteristics to activate, maintain, and deactivate the physical connections for the bit transmission.

This layer is implemented using the RS-449 standard. See Reference 5 for hardware information and detailed descriptions of the RS-449 standard.

Appendix A. File Formats

A.1 General File Format for UPS/Electronic User Blocked Messages

UPS/electronic user blocked messages include SARs**,** USMs, SRMs, and SDNs*NCCDSMOC*ofThe file formats used have one or more records. Each record contains 582 data bytes. Figure A-1 shows the general format of a blocked message record.

Figure A-1.

The first 7 bytes are the record header parameters. They specify the total number of blocks (record), the block (record) number, and block data length. The remaining 574 bytes consist of the message subfield of the original Nascom block. The network control header, user header, time field, and error field are removed. Each record contains at most one message. Messages longer than the 574-byte record size will use more than one record.

A.2 General File Format for UPS/Electronic User Nonblocked Messages

UPS/electronic user nonblocked messages include ISRs, report generation and report messages, retransmission requests, and validation status messages. Files transferred between the UPS and electronic users contain a 9-byte message header, which includes message number and size, and a variable-length message. For reports going to the electronic user, a linefeed will be placed at the end of each line of the report. Figure A-2 shows the general format of a nonblocked message record. ’

A.3 UPS/Electronic User Interface Message Formats

A memorandum of understanding (MOU) between the UPS and electronic users may be required on specific interface requirements, including the file-naming convention. Tables A-1 through A-7 detail each message format. I“”“”“”

Table A-1. Orbital Data Status Message Format

Item	Bytes	Data Description	Range of Values
1	02	Message Type	97 = Orbital data
2	07	Message ID	Seven-digit number used to reference this message from item 2 of PSAT or UAV message
3	02	Message Class	09 = Acknowledgment/status message
4	07	SUPIDEN	Refer to STDN 808 (Reference 17)
5	02	Orbit data type	04 = PSAT 05 = UAV
6	11	Start Time	yydddhhmmss
7	11	Stop Time	yydddhhmmss
8	160	Status Message	Text indicating validation status (“Valid” indicates pass validation)

Table A-2. Report Generation Request Message Format

Item	Bytes	Data Description	Range of Values
1	02	Message Type	93 = UPS database access message type
2	07	Message ID	Seven-digit number used to reference this message when returning status message to electronic user
3	02	Message Class	40 = Report request message class
4	04	SIC	nnnn = Spacecraft identification code
5	04	User ID	aaaa
6	04	Password	Alphanumeric code
7	02	Report ID	01 = Requested event 02 = Confirmed schedule 03 = Rejected event 04 = Untransmitted event 05 = Transmitted event 06 = Autogenerated event 07 = Deleted request/schedule 08 = Generic schedule 09 = Daily support plan 10 = Spacecraft individual pass plan 11 = Predicted Sun interference period 12 = Predicted anomaly period 13 = Configuration code 14 = Prototype event 15 = Spacecraft characteristics parameters 16 = User-defined constraint periods 17 = Activity log
8	11	Start Time	yydddhhmmss (for report IDs 01-12, 16, and 17)
9	11	Stop Time	yydddhhmmss (for report IDs 01-12, 16, and 17)
10	01	Anomaly Code	A = Uppercase alpha character specifying anomaly (mission-specific) (for report ID 12 only)

Table A-3. Report Generation Response Message Format

Item	Bytes	Data Description	Range of Values
1	02	Message Type	93 = UPS database access message type
2	07	Message ID	Seven-digit number corresponding to report request message ID (0 if report sent from interactive user)
3	02	Message Class	40 = Report request message class
4	04	SIC	nnnn = Spacecraft identification code
5	04	User ID	aaaa
6	04	Password	Alphanumeric code
7	02	Report ID	01 = Requested event 02 = Confirmed schedule 03 = Rejected event 04 = Untransmitted event 05 = Transmitted event 06 = Autogenerated event 07 = Deleted request/schedule 08 = Generic schedule 09 = Daily support plan 10 = Spacecraft individual pass plan 11 = Predicted Sun interference period 12 = Predicted anomaly period 13 = Configuration code 14 = Prototype event 15 = Spacecraft characteristics parameters 16 = User-defined constraint periods 17 = Activity log
8	Variable	Report	Report contents, each line separated by linefeed

Table A-4. ISR Message Format

Table A-5. SAR/SDR/ISR Status Message Format

Item	Bytes	Data Description	Range of Values
1	02	Message Type	99 = Schedule request message type
2	07	Message ID	Seven-digit number corresponding to SAR/ISR message used when returning status message to electronic user
3	02	Message Class	22 = Validation status message
4	07	SUPIDEN	Refer to STDN 808 (Reference 17)
5	04	User ID	aaaa
6	04	Password	Alphanumeric code
7	11	Start Time	yydddhhmmss
8	11	Stop Time	yydddhhmmss
9	400	Status Message	Text indicating validation status (“Valid” indicates pass validation)

Table A-6. Multiple-Action (Delete) Request Message Format

*Range of start and stop times for events to be deleted.

Table A-7. Multiple-Action (Time Shift) Request Message Format

*Range of start and stop times for events to be shifted.

Appendix B. Report Formats

B.1 Report Response Output Line Format

This appendix provides samples of each of the report formats generated by UPS, including

- Requested events report
- Confirmed schedules report
- Rejected events report
- Untransmitted events report
- Transmitted events report
- Autogenerated events report
- Deleted request/schedules report
- Generic schedules report
- Daily support plan
- Spacecraft individual pass plan
- Predicted Sun interference period report
- Predicted anomaly periods report
- Configuration codes report
- Prototype event report
- Spacecraft characteristics report
- User-defined constraint periods report
- Activity log report

Abbreviations and Acronyms

ASCII	American Standard Code for Information Interchange
CCB	Configuration Control Board
COBE	Cosmic Background Explorer
DCN	document change notice
DECnet	Digital Equipment Corporation network
DFCD	data format control document
EBCDIC	Extended Binary Coded Decimal Interchange Code
FDF	Flight Dynamics Facility
FOT	Flight Operations Team
FTP	file transfer protocol
GSFC	Goddard Space Flight Center
ICD	interface control document
IEEE	Institute of Electrical and Electronic Engineers
IP	Internet protocol
ISO	International Standards Organization
ISR	input schedule request
LAN	local area network
LOS	line–of–sight
LSB	least significant bit
MOD	Mission Operations Division
MOU	memorandum of understanding
MPT	mission planning terminal
MSOCC	Multisatellite Operations Control Center
MSS	Message Switching System
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications

NCC	Network Control Center
NCCDS	NCC Data System
OSI	Open Systems Interconnection
POCC	Payload Operations Control Center
PSAT	predicted site acquisition table
SAR	schedule add request
SDN	schedule delete notification
SDR	schedule delete request
SIC	spacecraft identification code
SMTP	small mail transfer protocol
SN	space network
SRM	schedule result message
SUPIDEN	support identification number
TCP	transmission control protocol
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TSW	TDRS scheduling window
UAV	user antenna view
UPS	User Planning System
USM	user schedule message

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